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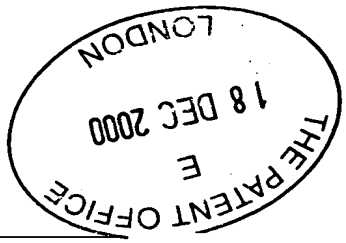

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Request for grant of a Patent

Form 1/77

Patents Act 1977

1 Title of invention

1 Please give the title of the invention

NOVEL POLYPEPTIDE

2 Applicant's details

☐ **First or only applicant**

2a If you are applying as a corporate body please give:

Corporate name
PFIZER LIMITED

Country *(and State of incorporation, if appropriate)*
UNITED KINGDOM

2b If you are applying as an individual or one of a partnership please give in full:

Surname

Forenames

2c **In all cases,** please give the following details:

Address
RAMSGATE ROAD
SANDWICH
KENT

UK postcode CT13 9NJ
(if applicable)

Country UNITED KINGDOM

ADP number
(if known) 6892673001

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⬇ *Please give details below*

Agent's name
DR. B. PETER
Agent's address
PFIZER LIMITED
RAMSGATE ROAD
SANDWICH
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Postcode CT13 9NJ

Agent's ADP number 6892673001

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If you have appointed an agent, all correspondence concerning your application will be sent to the agent's United Kingdom address.

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5 Are you claiming that this application be treated as having been filed on the date of filing of an earlier application?

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6

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Please supply duplicates of claim(s), abstract, description and drawing(s).

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Continuation sheets for this Patents Form 1/77			
Claim(s)	5	Description	15
Abstract		Drawing(s)	5

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Patents Form 9/77 - Preliminary Examination/Search	
Patents Form 10/77 - Request for Substantive Examination	

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NOVEL POLYPEPTIDE

Technical field

The present invention relates to a novel polynucleotide sequence which encodes a novel polypeptide belonging to the class of proteins known as G-protein coupled receptors (GPCRs). The present invention also relates, inter alia, to processes for producing the polypeptide and its uses.

Background of the invention

Cells and tissues respond to a wide variety of extracellular signalling molecules through the interaction of these molecules with specific cell-surface receptors. One such class of receptors are known as G-protein coupled receptors (GPCRs) and these are characterised by containing a series of 7 hydrophobic transmembrane segments. Upon binding an extracellular ligand to its receptor, intracellular signals are initiated via interactions with heterotrimeric G proteins which in turn can lead to a number of different intracellular events depending upon which receptor has been activated. For example some GPCRs influence adenyl cyclase activity whereas others act via phospholipase C.

Members of the GPCR superfamily respond to a wide variety of ligands including small molecule amines (such as serotonin, dopamine, acetylcholine), lipid-derived mediators (such as LpA), amino acid derivatives (such as glutamate) and neurotransmitter peptides and hormones (such as neurokinin, galanin, glucagon, gastrin). Although GPCRs are activated by a broad range of ligands, it should be noted that individual GPCRs have a small and very specific repertoire of ligands. Based upon an analysis of the primary structure of a novel GPCR, it is now possible to classify them into specific sub-families, thereby narrowing the range of potential ligands.

In many cases, the endogenous ligands of GPCRs are relatively small, enabling them to be mimicked or blocked by synthetic analogues. For example drugs such as prazosin,

doxazosin, cimetidine, ranitidine are all effective antagonists of their respective target GPCRs.

Thus, as the activation or inhibition of GPCRs can have therapeutic consequences, there is a continued need to provide new GPCRs and their associated agonists and antagonists.

Summary of the invention

According to one aspect of the present invention, there is provided an isolated polynucleotide comprising:

(a) a polynucleotide encoding the polypeptide as set forth in Figure 2;

(b) a polynucleotide encoding the polypeptide expressed by the DNA contained in National Collection of Industrial and Marine Bacteria Limited (NCIMB) Deposit No. [redacted];

(c) a polynucleotide comprising a nucleotide sequence of Figure 1;

(d) a polynucleotide comprising a nucleotide sequence that has at least 70-75% identity to the polynucleotide of any one of (a) to (c);

(e) a polynucleotide comprising a nucleotide sequence which is capable of hybridising to the polynucleotide of any one of (a) to (d); or

(f) a polynucleotide fragment of the polynucleotide of any one of (a) to (e).

Preferably, the polynucleotide comprises a nucleotide sequence that has at least 75-80% identity to the polynucleotide of any one of (a) to (c) above. More preferably, the polynucleotide comprises a nucleotide sequence that has at least 80-85% identity to the polynucleotide of any one of (a) to (c) above. Even more preferably, the polynucleotide comprises a nucleotide sequence that has at least 85-90% identity to the polynucleotide of any one of (a) to (c) above. Yet more preferably, the polynucleotide comprises a nucleotide sequence that has at least 90-95% identity to the polynucleotide of any one of (a) to (c) above. Most preferably, the polynucleotide comprises a nucleotide sequence that has greater than 95% identity to the polynucleotide of any one of (a) to (c) above.

Preferably, the polynucleotide encodes a mature polypeptide encoded by the DNA contained in NCIMB Deposit No. [redacted].

The polynucleotide described above preferably encodes a G-protein coupled receptor (GPCR).

The present invention also provides a polynucleotide probe or primer comprising at least 15 contiguous nucleotides of the polynucleotide described above.

The present invention yet further provides a vector comprising the polynucleotide described above.

According to a further aspect of the present invention, there is provided a host cell transformed or transfected with the vector described above. Preferably, the host cell is a mammalian, bacterial or yeast cell.

According to yet a further aspect of the present invention, there is provided a process for producing a polypeptide or fragment thereof comprising culturing said host cell under conditions sufficient for the expression of said polypeptide or fragment. Preferably, said polypeptide or fragment is expressed at the surface of said cell. The process preferably further includes recovering the polypeptide or fragment from the culture.

There is also provided by the present invention a process for producing cells capable of expressing a polypeptide or fragment thereof comprising transforming or transfecting cells with the vector described above.

According to a further embodiment of the present invention, there are provided cells produced by the process described above. There is also provided a membrane preparation of said cells.

According to another aspect of the present invention, there is provided a polypeptide comprising:

(a) a polypeptide having the deduced amino acid sequence translated from the polynucleotide sequence in Figure 1 and variants, fragments, homologues, analogues and derivatives thereof;

(b) a polypeptide of Figure 2 and variants, fragments, homologues, analogues and derivatives thereof; or

(c) a polypeptide encoded by the cDNA of NCIMB Deposit No. [redacted] and variants, fragments, homologues, analogues and derivatives of said polypeptide.

There is also provided by the present invention an antibody against the polypeptide described above.

The present invention yet further provides a compound which activates the polypeptide described above (an agonist) or which inhibits activation of the polypeptide described above (an antagonist).

According to another aspect of the present invention, there is provided a method for identifying a compound which binds to and activates the polypeptide described above comprising:

(a) contacting a compound with cells expressing on the surface thereof the polypeptide or a membrane preparation of said cells, said polypeptide being associated with a second component capable of providing a detectable signal in response to the binding of a compound to said polypeptide; said contacting being under conditions sufficient to permit binding of compounds to the polypeptide; and

(b) identifying a compound capable of polypeptide binding by detecting the signal produced by said second component.

According to another aspect of the present invention, there is provided a method for identifying a compound which binds to and inhibits activation of the polypeptide described above comprising:

(a) contacting (i) a detectable first component known to bind to and activate the polypeptide and (ii) a compound with cells expressing on the surface thereof the polypeptide or a membrane preparation of said cells, said polypeptide being associated with a second component capable of providing a detectable signal in response to the binding of a compound to said polypeptide; said contacting being under conditions sufficient to permit binding of compounds to the polypeptide; and

(b) determining whether the first component binds to the polypeptide by detecting the absence or otherwise of a signal generated from the interaction of the first component with the polypeptide.

As GPCRs are involved in signal transduction, agonists or antagonists of the polypeptide of the present invention can find use in interfering in the signal transduction process. Consequently, the present invention provides a compound which activates the polypeptide described above (an agonist) or which inhibits activation of the polypeptide described above (an antagonist) for use as a pharmaceutical. Such compounds, which can act as agonists or antagonists of the polypeptide, can therefore find use in the therapeutic areas which concern aspects of signal transduction. Therapeutically usefully areas include, but are not limited to, neurological disease, psychotherapeutics, urogenital disease, reproduction and sexual medicine, inflammation, cancer, tissue repair, dermatology, skin pigmentation, photoageing, frailty, osteoporosis, metabolic disease, cardiovascular disease, gastrointestinal disease, antiinfection, allergy and respiratory disease, sensory organ disorders, sleep disorders and hairloss.

Accordingly, there is also provided the use of the above compound (agonist) in the manufacture of a medicament in the treatment of a patient having need to activate a receptor.

There is also provided the use of the above compound (antagonist) in the manufacture of a medicament in the treatment of a patient having need to inhibit a receptor.

According to yet a further aspect of the invention, there is provided a method for the treatment of a patient having need to activate a receptor comprising administering to the

patient a therapeutically effective amount of the above-described compound (agonist). Preferably, said compound (agonist) is a polypeptide and a therapeutically effective amount of the compound is administered by providing to the patient DNA encoding said compound and expressing said compound in vivo.

According to yet a further aspect of the invention, there is also provided a method for the treatment of a patient having need to inhibit a receptor comprising administering to the patient a therapeutically effective amount of the above-described compound (antagonist). Preferably, said compound (antagonist) is a polypeptide and a therapeutically effective amount of the compound is administered by providing to the patient DNA encoding said compound and expressing said compound in vivo.

There is also provided by the present invention a method for the treatment of a patient having need to activate or inhibit a receptor, comprising administering to the patient a therapeutically effective amount of the antibody described above.

Yet further provided by the present invention is use of the antibody described above in the manufacture of a medicament for the treatment of a patient having need to activate or inhibit a receptor.

According to a further aspect of the present invention, there is provided a method of treatment of a patient having need to upregulate a receptor, comprising administering to the patient a therapeutically effective amount of the polypeptide of the present invention. Preferably, said therapeutically effective amount of the polypeptide is administered by providing to the patient DNA encoding said polypeptide and expressing said polypeptide in vivo.

There is also provided by the present invention, use of the polypeptide in the manufacture of a medicament for the treatment of a patient having need to upregulate a receptor.

According to yet a further aspect of the present invention, there are provided cells or an animal genetically engineered to overexpress, underexpress or to exhibit targeted deletion of the polypeptide of the present invention.

Detailed description of the invention

The present invention will now be described, by way of example only, with reference to the accompanying figures, wherein:

Figure 1 shows the nucleotide sequence coding for PFI-020. The ATG translation initiation codon is indicated by the first three letters. The stop codon is indicated by the last three letters.

Figure 2 shows the corresponding amino acid sequence coding for PFI-020.

Figure 3 shows a ClustalW Alignment of PFI-020 with the P2U purinoceptor 1 (P2U1).

Figure 4 shows the results of a functional, cell-based assay, showing the activation of PFI-020 by various nucleotide analogues, using a FLIPR® technology. Each square contains the fluorescence trace measured in the well of a 96-well plate in the corresponding position.

Figure 5 shows the results of a functional, cell-based assay, showing the activation of PFI-020 by uridine triphosphate, using a FLIPR® technology. Each square contains the fluorescence trace measured in the well of a 96-well plate in the corresponding position.

The polynucleotide which encodes the GPCR of the present invention was identified electronically and analysed using various bioinformatic tools. The GPCR encoded by the sequences described herein has been termed PFI-020.

The term "nucleotide sequence" as used herein refers to an oligonucleotide sequence or polynucleotide sequence, and variants, homologues, fragments and derivatives thereof (such as portions thereof). The nucleotide sequence may be DNA or RNA of genomic or synthetic or recombinant origin which may be double-stranded or single-stranded whether representing the sense or antisense strand.

Preferably, the term "nucleotide sequence" means DNA.

More preferably, the term "nucleotide sequence" means DNA prepared by use of recombinant DNA techniques (i.e. recombinant DNA).

In a preferred embodiment, the present invention does not cover the native nucleotide coding sequence according to the present invention in its natural environment when it is under the control of its native promoter which is also in its natural environment. For ease of reference, we shall call this preferred embodiment the "non-native nucleotide sequence".

As used herein "amino acid sequence" refers to peptide or protein sequences or portions thereof.

In a preferred embodiment, the present invention does not cover the native PFI-020 according to the present invention when it is in its natural environment and when it has been expressed by its native nucleotide coding sequence which is also in its natural environment and when that nucleotide sequence is under the control of its native promoter which is also in its natural environment. For ease of reference, we shall call this preferred embodiment the "non-native amino acid sequence".

As used herein "naturally occurring" refers to a PFI-020 with an amino acid sequence found in nature.

As used herein "biologically active" refers to a PFI-020 having structural, regulatory or biochemical functions of the naturally occurring PFI-020.

As used herein, "immunological activity" is defined as the capability of the natural, recombinant or synthetic PFI-020 or any oligopeptide thereof, to induce a specific immune response in appropriate animals or cells and to bind with specific antibodies.

The term "derivative" as used herein includes chemical modification of a PFI-020.

As used herein, the terms "isolated" and "purified" refer to molecules, either nucleic or amino acid sequences, that are removed from their natural environment and isolated or separated from at least one other component with which they are naturally associated. For example, for nucleic acid sequences, the nucleic acid must be separated from at least one of the genes with which it is naturally associated.

The terms "variant", "homologue" or "fragment" in relation to the amino acid sequence for the preferred polypeptide of the present invention include any substitution of, variation of, modification of, replacement of, deletion of or addition of one (or more) amino acid from or to the sequence providing the resultant polypeptide has PFI-020 activity. In particular, the term "homologue" covers homology with respect to structure and/or function.

The terms "variant", "homologue" or "fragment" in relation to the nucleotide sequence coding for the preferred polypeptide of the present invention include any substitution of, variation of, modification of, replacement of, deletion of or addition of one (or more) nucleic acid from or to the sequence providing the resultant nucleotide sequence codes for or is capable of coding for a polypeptide having PFI-020 activity. In particular, the term "homologue" covers homology with respect to structure and/or function providing the resultant nucleotide sequence codes for or is capable of coding for an enzyme having PFI-020 activity. With respect to sequence homology (i.e. identity), preferably there is at least 70-75%, more preferably at least 75-80%, more preferably at least 80-85%, more preferably 85-90%, yet more preferably 90-95%, and most preferably greater than 95% identity to the polynucleotide sequence shown in Figure 1.

In particular, the term "homology" as used herein may be equated with the term "identity". Relative sequence homology (i.e. sequence identity) can be determined by commercially available computer programs that can calculate % homology between two or more sequences. A typical example of such a computer program is CLUSTAL.

As used herein, the terms "variant", "homologue", "fragment" and "derivative" also include allelic variations of the sequences.

The term "variant" also encompasses sequences that are complementary to sequences that are capable of hydridising to the nucleotide sequences presented herein. Preferably, the term "variant" encompasses sequences that are complementary to sequences that are capable of hydridising under stringent conditions (e.g. 65°C and 0.1xSSC {1xSSC = 0.15 M NaCl, 0.015 Na3 citrate pH 7.0}) to the nucleotide sequences presented herein.

The present invention also covers nucleotide sequences that can hybridise to the nucleotide sequences of the present invention (including complementary sequences of those presented herein). In a preferred aspect, the present invention covers nucleotide sequences that can hybridise to the nucleotide sequence of the present invention under stringent conditions (e.g. 65°C and 0.1xSSC).

The term "vector" includes expression vectors and transformation vectors.

The term "expression vector" means a construct capable of in vivo or in vitro expression.

The term "transformation vector" means a construct capable of being transferred from one species to another.

The identification of PFI-020

PFI-020 was identified in the Celera nucleotide database by searching the sequences with known members of the G-protein coupled receptor (GPCR) family using the BLAST algorithm. In order to confirm that PFI-020 was a member of the GPCR family, a number of bioinformatics approaches were performed.

(a) BLAST Search against Swissprot

PFI-020 was searched against Swissprot using the BLAST algorithm (Basic Local Alignment Search Tool (Altschul SF (1993) J.Mol. Evol. 36:290-300; Altschul, SF et al (1990) J. Mol. Biol. 215:403-410) to identify the closest protein match. In this case the top hit was to:

P41231, P2U purinoceptor 1 (P2U1) .

These results indicate that PFI-020 is a member of the GPCR family.

(b) ClustalW Alignment of PFI-020 with the P2U purinoceptor 1 (P2U1).

These results are shown in Figure 3.

(c) BLAST search against a non-redundant human GPCR database

PFI-020 was searched against a non-redundant human GPCR database comprising mainly sequences from Genbank and the Derwent Geneseq databases in order to identify the class of potential agonists for this receptor. The top ten hits are shown below:

P2U purinoceptor 1 (P2U1) [L:377]	235	5e-63
Uridine nucleotide receptor (UNR) [L:...	228	8e-61
P2Y purinoceptor 6 (P2Y6) [L:328]	204	1e-53
P2Y purinoceptor 1 (P2Y1) [L:373]	179	5e-46
Purinoceptor homologue 6575963CD1 (incyte...	150	3e-37
G protein-coupled receptor GPR17 [L:339]	147	2e-36
P2Y purinoceptor 5 (P2Y5) [L:344]	139	3e-34
P2Y purinoceptor 9 (P2Y9) [L:370]	139	6e-34

Proteinase activated receptor 3 (PAR-3...	130	2e-31
Cysteinyl leukotriene receptor (CYSLT1) ...	125	1e-29

(e value = statistical likelihood of the hit occurring by chance)

These results demonstrate that PFI-020 is most similar to purinergic receptors, and they suggest that PFI-020 encodes a novel GPCR whose ligand is likely to be a nucleotide or nucleotide derivative.

It will be appreciated that the foregoing is provided by way of example only and modification of detail may be made without departing from the scope of the invention.

Example 3

ISOLATION OF PFI-020

Utilising PFI-020 gene specific primers (PFI-020 forward and PFI-020 reverse; SEQ ID NOs: 3 and 4, respectively) these were employed in a PCR to amplify the PFI-020 coding region from human genomic DNA (Boehringer Mannheim), where the conditions were as follows:-

PCR mix:

PFI-020 primers	1 µl (10 µM stock)
Human genomic DNA	2 µl (400ng)
dNTPs (concentration as per kit)	1 µl
platinum Taq high fidelity Polymerase (LTI, Inc.)	0.5 µl
10x amplification Buffer (from PCR kit)	5 µl
$MgSO_4$	1.5 µl
dH_2O	39 µl

PCR primers:

Forward Primer (= PFI-020 forward):

5'- ACC ATG CTG TCC ATT TTG CTT CCT TCC-3' (SEQ ID NO: 3)

Reverse Primer (= PFI-020 reverse):

5'- TCA GTT TCT GGA GGA GCC TGA CTC-3' (SEQ ID NO: 4)

PCR cycle:

(1) 94 °C 2 mins

(2) 94°C 30 seconds

(3) 54°C 30 seconds

(4) 68°C 2 mins

Steps (2) through to (4) were repeated for a further 27 cycles.

(5) 68°C 15 mins

(6) 4°C soak.

The PFI-020 PCR product was TOPO cloned (Invitrogen TOPO cloning methodology) into the vector pcDNA4.1/His-Max-TOPO (Invitrogen), according to the manufacturer's instructions. The resulting insert was subsequently sequence-verified on both strands using ABI DNA sequencing methodology as per the manufacturer's protocol.

Example 4

TISSUE DISTRIBUTION OF PFI-020

Electronic northern identifies an EST in a brain cDNA library.

Example 5

FUNCTIONAL CELL-BASED ASSAYS FOR AGONIST ACTIVATION OF PFI-020

Fluorescence Imaging Plate Reader (FLIPR®) technology was employed as a means to detect activation of PFI-020 by agonists in a cell-based assay.

5 x 10^6 Human Embryonic Kidney (HEK) 293 cells expressing the mouse Gα15 gene (from here on called '293 cells'), were transiently transfected with 7.5 μg of PFI-020 (contained within the pcDNA4HIS-max-TOPO (Invitrogen) plasmid) vector, or vector alone, using Lipofectamine Plus® reagent (Gibco BRL) as per the manufacturer's protocol. The plasmid pcDNA4HIS-max-TOPO was used as it contains elements that up-regulate the level of gene transcription over standard pcDNA3.1 vectors. 24 hrs post-transfection, the cells were detached from the flask using Trypsin/EDTA solution (LTI) and seeded into a black sided, poly-D-lysine-treated, 96-well plate (Becton Dickinson) at 5 x 10^4 cells/well density. The plates were left overnight to allow the cells to adhere to the bottom of the wells. The medium was removed from the cells and replaced with 100 μl warm (37°C) dye loading solution (50 μg Fluo3 (Molecular Probes) in 20 μl DMSO + 20% pluronic acid in DMSO, added to 11 ml Dulbecco's Modified Eagles Medium containing 1x Probenecid (100x Probenecid - 0.71 g Probenecid was dissolved in 5 ml 1M NaOH and 5 ml Dulbeccos' Phosphate Buffered Saline (PBS), per plate; Probenecid (Molecular Probes) inhibits activity of the anion transport protein, thus improving dye loading). The plates were then incubated for 1 hr at 37°C. Plates were subsequently washed with 250 μl of wash buffer per well (5 ml 100x Probenecid stock + 495 ml PBS, pH 7.4) 4 times. The plates were returned to the 37°C/5%CO_2 incubator for 30 mins prior to processing within the FLIPR® instrument. The FLIPR® processing involved reading the fluorescence for all samples for 2 minutes; during this time the fluorescence baseline was determined for the first 10 seconds. The desired amount of compound was then automatically transferred to the wells and the fluorescence was continuously monitored for the remainder of the time. All compounds were diluted in wash buffer

Analysis of PFI-020 activation by various purinoceptor agonist compounds in a FLIPR® cell-based assay

Using methodology as described in detail above, purinoceptor agonist compounds were identified as being able to functionally activate PFI-020.

Figures 4 and 5 depict the action of various purinoceptor compounds at a concentration of 10 μM on PFI-020-transfected 293 cells. All compounds were purchased from Sigma. Vector-only transfected 293 cells gave no measurable response to these compounds. The

results indicate that PFI-020 is activated, by 2-chloroadenosine triphosphate tetrasodium (position F5 in Figure 4), 2-methylthioadenosine diphosphate trisodium (position F8 in Figure 4); 2-methylthioadenosine triphosphate tetrasodium (position G3, Figure 4) and Uridine triphosphate (position H10, Figure 5). All other responses are due to endogenously expressed receptors as these compounds illicit measurable responses in vector-only transfected 293 cells.

Claims

1. An isolated polynucleotide comprising:

(a) a polynucleotide encoding the polypeptide as set forth in Figure 2;

(b) a polynucleotide encoding the polypeptide expressed by the DNA contained in National Collection of Industrial and Marine Bacteria Limited (NCIMB) Deposit No. _____;

(c) a polynucleotide comprising a nucleotide sequence of Figure 1;

(d) a polynucleotide comprising a nucleotide sequence that has at least 70-75% identity to the polynucleotide of any one of (a) to (c);

(e) a polynucleotide comprising a nucleotide sequence which is capable of hybridising to the polynucleotide of any one of (a) to (d); or

(f) a polynucleotide fragment of the polynucleotide of any one of (a) to (e).

2. The polynucleotide of claim 1, comprising a nucleotide sequence that has at least 75-80% identity to the polynucleotide of any one of (a) to (c).

3. The polynucleotide of claim 1, comprising a nucleotide sequence that has at least 80-85% identity to the polynucleotide of any one of (a) to (c).

4. The polynucleotide of claim 1, comprising a nucleotide sequence that has at least 85-90% identity to the polynucleotide of any one of (a) to (c).

5. The polynucleotide of claim 1, comprising a nucleotide sequence that has at least 90-95% identity to the polynucleotide of any one of (a) to (c).

6. The polynucleotide of claim 1, comprising a nucleotide sequence that has greater than 95% identity to the polynucleotide of any one of (a) to (c).

7. The polynucleotide of claim 1, wherein said polynucleotide encodes a mature polypeptide encoded by the DNA contained in NCIMB Deposit No. _____.

8. The polynucleotide of any one of the preceding claims which encodes a G-protein coupled receptor (GPCR).

9. A polynucleotide probe or primer comprising at least 15 contiguous nucleotides of the polynucleotide of any one of the preceding claims.

10. A vector comprising the polynucleotide of any one of the preceding claims.

11. A host cell transformed or transfected with the vector of claim 10.

12. The host cell of claim 11 which is a mammalian, bacterial or yeast cell.

13. A process for producing a polypeptide or fragment thereof comprising culturing the host cell of claim 11 or claim 12 under conditions sufficient for the expression of said polypeptide or fragment.

14. The process of claim 13, wherein said polypeptide or fragment is expressed at the surface of said cell.

15. The process of claim 13 or claim 14 which further includes recovering the polypeptide or fragment from the culture.

16. A process for producing cells capable of expressing a polypeptide or fragment thereof comprising transforming or transfecting cells with the vector of claim 10.

17. Cells produced by the process of claim 14.

18. A membrane preparation of the cells of claim 17.

19. A polypeptide comprising:

(a) a polypeptide having the deduced amino acid sequence translated from the polynucleotide sequence in Figure 1 and variants, fragments, homologues, analogues and derivatives thereof;

(b) a polypeptide of Figure 2 and variants, fragments, homologues, analogues and derivatives thereof; or

(c) a polypeptide encoded by the cDNA of NCIMB Deposit No. [redacted] and variants, fragments, homologues, analogues and derivatives of said polypeptide.

20. An antibody against the polypeptide of claim 19.

21. A compound (agonist) which activates the polypeptide of claim 19.

22. A compound (antagonist) which inhibits activation of the polypeptide of claim 19.

23. A method for identifying a compound which binds to and activates the polypeptide of claim 19 comprising:

(a) contacting a compound with cells expressing on the surface thereof the polypeptide of claim 19 or a membrane preparation of said cells, said polypeptide being associated with a second component capable of providing a detectable signal in response to the binding of a compound to said polypeptide; said contacting being under conditions sufficient to permit binding of compounds to the polypeptide; and

(b) identifying a compound capable of polypeptide binding by detecting the signal produced by said second component.

24. A method for identifying a compound which binds to and inhibits activation of the polypeptide of claim 19 comprising:

(a) contacting (i) a detectable first component known to bind to and activate the polypeptide of claim 19 and (ii) a compound with cells expressing on the surface thereof the polypeptide of claim 19, or a membrane preparation of said cells, said polypeptide being associated with a second component capable of providing a detectable signal in response to the binding of a compound to said polypeptide; said contacting being under conditions sufficient to permit binding of compounds to the polypeptide; and

(b) determining whether the first component binds to the polypeptide by detecting the absence or otherwise of a signal generated from the interaction of the first component with the polypeptide.

25. The compound of claim 21 or claim 22 for use as a pharmaceutical.

26. Use of the compound (agonist) of claim 21 in the manufacture of a medicament in the treatment of a patient having need to activate a receptor.

27. Use of the compound (antagonist) of claim 22 in the manufacture of a medicament in the treatment of a patient having need to inhibit a receptor.

28. A method for the treatment of a patient having need to activate a receptor comprising administering to the patient a therapeutically effective amount of the compound of claim 21.

29. The method of claim 28, wherein said compound is a polypeptide and a therapeutically effective amount of the compound is administered by providing to the patient DNA encoding said compound and expressing said compound in vivo.

30. A method for the treatment of a patient having need to inhibit a receptor comprising administering to the patient a therapeutically effective amount of the compound of claim 22.

31. The method of claim 30, wherein said compound is a polypeptide and a therapeutically effective amount of the compound is administered by providing to the patient DNA encoding said compound and expressing said compound in vivo.

32. A method for the treatment of a patient having need to activate or inhibit a receptor, comprising administering to the patient a therapeutically effective amount of the antibody of claim 20.

33. Use of the antibody of claim 20 in the manufacture of a medicament for the treatment of a patient having need to activate or inhibit a receptor.

34. A method of treatment of a patient having need to upregulate a receptor, comprising administering to the patient a therapeutically effective amount of the polypeptide of claim 19.

35. The method of claim 34, wherein said therapeutically effective amount of the polypeptide is administered by providing to the patient DNA encoding said polypeptide and expressing said polypeptide in vivo.

36. Use of the polypeptide of claim 19 in the manufacture of a medicament for the treatment of a patient having need to upregulate a receptor.

37. Cells or animals genetically engineered to overexpress the polypeptide of claim 19.

38. Cells or animals genetically engineered to underexpress the polypeptide of claim 19.

39. Cells or animals genetically engineered to exhibit targeted deletion of the polypeptide of claim 19.

Figure 1

Nucleotide sequence coding for PFI-020

atgctgtccattttgcttccttccaggggaagcagaagcgggagccgtcgtggagctct
gctcctggagggagcctcccgggacatggagaaggtggacatgaatacatcacaggaac
aaggtctctgccagttctcagagaagtacaagcaagtctacctctccctggcctacagt
atcatctttatcctagggctgccactaaatggcactgtcttgtggcactcctggggcca
aaccaagcgctggagctgtgccaccacctatctggtgaacctgatggtggccgacctgc
tttatgtgctattgcccttcctcatcatcacctactcactagatgacaggtggcccttc
ggggagctgctctgcaagctggtgcacttcctgttctatatcaacctttacggcagcat
cctgctgctgacctgcatctctgtgcaccagttcctaggtgtgtggcacccactgtgtt
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gatgatctggtatgacatgaccagccaagagaattttgatcggctttttgcctacggca
tagttctgacattgtctggctttctttccccctccttggtcattttggtgtgctattca
ctgatggtcaggagcctgatcaagccagaggagaacctcatgaggacaggcaacacagc
ccgagccaggtccatccggaccatcctactggtgtgtggcctcttcaccctctgttttg
tgcccttccatatcactcgctccttctacctcaccatctgctttctgctttctcaggac
tgccagctcttgatggcacccagtgtggcctacaagatatggaggcctctggtgagtgt
gagcagctgcctcaacccagtcctgtactttctttcaaggggggcaaaaatagagtcag
gctcctccagaaactga

Figure 2

Amino acid sequence coding for PFI-020

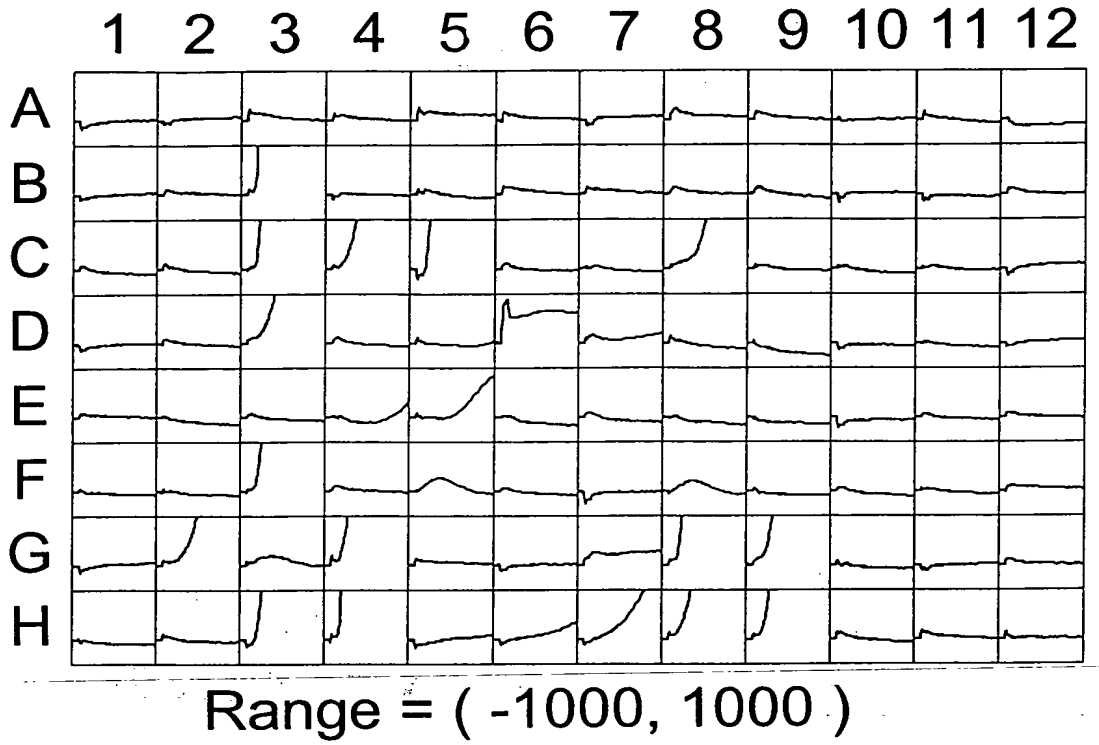
MLSILLPSRGSRSGSRRGALLLEGASRDMEKVDMNTSQEQGLCQFSEKYKQVYLSLAYSI
IFILGLPLNGTVLWHSWGQTKRWSCATTYLVNLMVADLLYVLLPFLIITYSLDDRWPFGE
LLCKLVHFLFYINLYGSILLLTCISVHQFLGVWHPLCSLPYRTRRHAWLGTSTTWALVVL
QLLPTLAFSHTDYINGQMIWYDMTSQENFDRLFAYGIVLTLSGFLSPSLVILVCYSLMVR
SLIKPEENLMRTGNTARARSIRTILLVCGLFTLCFVPFHITRSFYLTICFLLSQDCQLLM
APSVAYKIWRPLVSVSSCLNPVLYFLSRGAKIESGSSRN

Figure 3

ClustalW Alignment of PFI-020 with P2U purinoceptor 1 (P2U1)

```
P2U1            MAADLGPWNDTINGTWDGD---ELGYR---------------CRFNEDFKYVLLPVSYGV
PFI-020         MLSILLPSRGSRSGSRRGALLLEGASRDMEKVDMNTSQEQGLCQFSEKYKQVYLSLAYSI
                * : * * ..: .*:  *    * . *                *:*.*.:* * *.::*.:

P2U1            VCVLGLCLNAVALYIFLCRLKTWNASTTYMFHLAVSDALYAASLPLLVYYYARGDHWPFS
PFI-020         IFILGLPLNGTVLWHSWGQTKRWSCATTYLVNLMVADLLYVL-LPFLIITYSLDDRWPFG
                : :*** **...*:    : * *..:***:.:* *:* **.  **:*:  *: .*:***.

P2U1            TVLCKLVRFLFYTNLYCSILFLTCISVHRCLGVLRPLRSLRWGRARYARRVAGAVWVLVL
PFI-020         ELLCKLVHFLFYINLYGSILLLTCISVHQFLGVWHPLCSLPYRTRRHAWLGTSTTWALVV
                 :*****:**** *** ***:*******: *** :** ** :   *:*   :.:.*.**:

P2U1            ACQAPVLYFVTTSARGGRVTCHDTSAPELFSRFVAYSSVMLGLLFAVPFAVILVCYVLMA
PFI-020         LQLLPTLAFSHTDYINGQMIWYDMTSQENFDRLFAYGIVLTLSGFLSPSLVILVCYSLMV
                    *.* *  *.  .*::  :* :: * *.*:.**. *:    *  *  ****** **.

P2U1            RRLLKP--AYGTSGGLPRAKRKSVRTIAVVLAVFALCFLPFHVTRTLYYSFRSLD-LSCH
PFI-020         RSLIKPEENLMRTGNTARA-R-SIRTILLVCGLFTLCFVPFHITRSFYLTICFLLSQDCQ
                * *:**      :*. .** * *:*** :* .:*:***:***:**::* ::  *   .*:

P2U1            TLNAINMAYKVTRPLASANSCLDPVLYFLAGQRLVRFARDAKPPTGPSPATPARRRLGLR
PFI-020         LLMAPSVAYKIWRPLVSVSSCLNPVLYFLS--------RGAKIESGSSRN----------
                 * * .:***: ***.*..***:******:        *.**  :*.*
-------------------------------------------------------------------------------
P2U1            RSDRTDMQRIGDVLGSSEDFRRTESTPAGSENTKDIRL
PFI-020         ---------------------------------------
```

Figure 4



Mini Graphs

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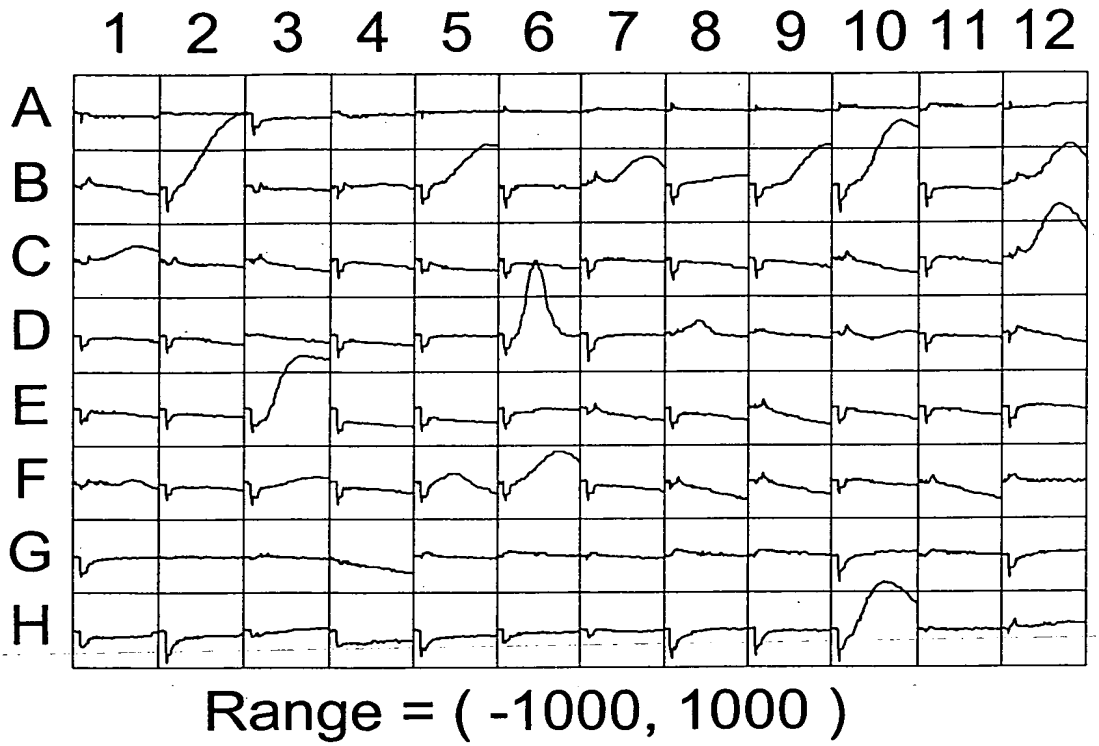
Figure 5



Mini Graphs